

ACCELERATOR DIVISION ADMINISTRATIVE PROCEDURE

ADAP-06-0019

FERMILAB MAIN INJECTOR PROJECT MANAGEMENT PROGRAM PLAN:

A Specific Quality Implementation Plan

RESPONSIBLE DEPARTMENT AD/MAIN INJECTOR DEPARTMENT

PREPARED BY W. B. Fowler  
W. B. Fowler and A. L. Read

4.23.93  
DATE 4/23/93

APPROVED BY S. D. Holmes  
S. Holmes, FMI Project Manager

DATE 4/24/93

REVISION NO. 0 REVISION ISSUE DATE 1-28-94

DIRECTOR APPROVAL

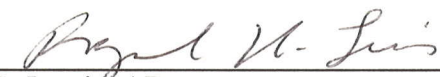
K. C. Stanfield 1/24/94  
Date


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REVIEW AND CONCURRENCE RECORD

REVIEWED BY  DATE: 23 April 93  
D. Bogert, Deputy FMI Project Manager

REVIEWED BY  DATE: 4-23-93  
R. Lewis, AD  
Representative to FNAL QAC

REVIEWED BY  DATE: 23 Apr 93  
R. Ducar, Associate AD Head for AESH



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## **FMI PROJECT SPECIFIC QUALITY IMPLEMENTATION PLAN**

### **1.0 PURPOSE AND SCOPE**

#### **1.1 Purpose**

The purpose of this Specific Quality Implementation Plan (SQIP) is to describe the Fermilab Main Injector (FMI) Project functions and organization and its implementation of Quality Assurance Criteria 1 through 10, as stated in the Fermilab Quality Assurance Program (dated April 1, 1992), and in conformance with the Accelerator Division (AD) SQIP, ADAP-06-0001, Rev. 1, and in compliance with DOE Order 5700.6C (dated June 21, 1991).

#### **1.2 Scope**

The description and requirements of this plan are generally applicable to all activities included in the FMI Project.

### **2.0 FMI PROJECT FUNCTIONAL ANALYSIS**

#### **2.1 Terminal Objectives**

To carry out the design, construction and commissioning of the FMI Project within the cost and schedule contained in the Project Management Plan (PMP). To assure attainment of design criteria for intensity and repetition rate. To assure compliance with all Quality Assurance, environmental, health and safety requirements.

#### **2.2 Subordinate Objectives**

To provide for the staffing of the Main Injector Department and the recruitment of Level 3 Managers (L3M) such that sufficient qualified and trained personnel are on hand in a timely fashion in order that the Terminal Objective can be accomplished.

To provide general overall guidance for the design of the Main Injector accelerator. This should be accomplished in time for a comprehensive design review prior to the initiation of construction.

To establish a design-change control system that will assure that design criteria are met with cost control and schedule milestones maintained.

To coordinate activities involving interactions between the Main Injector Department and other departments within the Accelerator Division (AD) and other Laboratory Divisions/Sections, including the Directorate and DOE.

To conduct tests of each sub-system as it becomes available. If any deficiency is detected when the tests have been evaluated, to initiate the necessary corrective action.

To prepare a quality assurance program that can be applied to all phases of the Main Injector Project, i.e., design, procurement, construction, testing, commissioning and operations.

To coordinate the turn-over of the operation of the Main Injector to the AD Operations Group, and the conversion of the Main Injector Department from a construction organization to a systems department.

### **3.0 FMI PROJECT ORGANIZATION**

The FMI Project organization is described in detail in the FMI PMP (see in particular, Section III).

### **4.0 FMI PROJECT QUALITY ASSURANCE IMPLEMENTATION PLAN**

#### **4.1 CRITERION 1 - PROGRAM**

4.1.1 This SQIP is based on the April 1, 1992 Fermilab Quality Assurance Plan (FQAP). Detailed Fermilab-wide requirements that are specified in the FQAP are not repeated here. The responsibility for execution of the FMI Project has been assigned by the Director to the AD. This is the basis for using an ADAP-series procedure to document this SQIP for the FMI.

4.1.2 The FMI mission statement has been documented in the approved Fermilab Main Injector (FMI) Project Plan, a Department of Energy (DOE) document dated May 1992. The objectives of the FMI project are to design, construct, commission, and operate a 150 GeV accelerator. The commissioning goals (Table 1.1) have been established to mark the end of construction and the beginning of routine operation for the experimental programs. The operational goals (Table 1.2) are for the facility after it has been in use for some months, recognizing that progressive improvements in performance occur as regular operations for the physics research program proceed.

4.1.3 Section III of the Project Organization and Responsibilities of the FMI Project Management Plan dated December 1992, pages 9 through 20, describes the organizational structure, functional responsibilities, and levels of authority of the project in accordance with DOE Order 4700.1, revised June 2, 1992. Most WBS L3M (see PMP, page 16) are members of the staff of the departments in the Accelerator Division (AD). In one case he is a member of the Main Injector Department and in another case he is a member of the Technical Support Section. In all cases their functional responsibilities and task descriptions at the group level are contained in their organization SQIP's. The AD SQIP requires all AD departments to have their own SQIP.

4.1.4 The FMI Project Manager draws on Fermilab resources as appropriate to meet the Project's objectives. To the extent practicable, the Project Manager draws on the technical expertise and administrative functions that exist at the Laboratory. Procedures consistent with the Laboratory's current accounting, budgeting, human resources, and procurement department policies will be followed and used throughout the Project.

The Project will obtain support to the extent appropriate from the Laboratory's indirect support sections, including:

- Business Services Section
- Technical Support Section
- Environment, Safety and Health Section
- Facilities Engineering Services Section

Each of the above organizations operate under their own SQIP.

A/E Title I, II and III civil construction services will be obtained from Fluor Daniel, an A/E firm. Fluor Daniel is required to have a QAP, subject to review and audit by Fermilab.



Table 1.1 Technical goals of the Fermilab Main Injector

Commissioning Goals	
Proton energy for injection into the Tevatron	150 GeV
- Number of protons injected per Tevatron cycle	$2 \times 10^{13}$
- Proton and antiproton transmission efficiencies	75%
Proton energy for antiproton production and test beams	120 GeV
Cycle Time to 120 GeV	2.5 sec.
- Protons to antiproton target per cycle	$2 \times 10^{12}$
- Protons slow spilled per cycle	$2 \times 10^{13}$

Table 1.2 Operational Goals after some months of operation\*

Proton energy for injection into the Tevatron	150 GeV
- Number of protons injected per Tevatron cycle	$6 \times 10^{13}$
- Proton and antiproton transmission efficiencies	95%
Proton energy for antiproton production and test beams	120 GeV
Cycle time to 120 GeV	1.5 sec.
- Protons to antiproton target per cycle	$5 \times 10^{12}$
- Protons slow spilled per cycle	$3 \times 10^{13}$

\*Based on the FMI Project Conceptual Design Report (Revision 3.1, dated April 1992)

The Project will procure services from the Laboratory's service organizations when cost-effective, in accordance with the Laboratory's make-or-buy policy. The Laboratory full cost recovery service centers include the following:

- Technical Support Section
- Facilities Engineering Services

All support functions will be provided through the Laboratory matrix organizational lines of authority and responsibility. The FMI Project Manager will direct all questions of priority need for Laboratory support assistance not satisfied through normal lines of authority to the Laboratory Director. Since the FMI Project Manager is initially also Head of the AD the needs of the AD will be automatically factored into any priority question. Arrangements for technical support staff from programmatic divisions will be made by the FMI Project Management Group. Key technical personnel will be temporarily assigned and will report directly to the FMI Project Manager.

The FMI Project is conducted as a team effort involving the DOE Office of Energy Research (ER), the DOE Office of High Energy and Nuclear Physics (HENP), the DOE Division of High Energy Physics ( DHEP), the DOE Chicago Field Office (CH), the DOE Batavia Area Office (BAO), and Fermilab. For the Project to progress rapidly, all parties need to be fully and promptly informed of progress, plans, issues, problems, solutions, and achievements.

Communication among participants is free and informal to the maximum extent feasible. Notes, "drafts", phone calls, electronic mail, and informal discussions are exchanged frequently among the participants to accomplish information flow, raise issues for mutual resolution, and explore the viability of plans and solutions. Distribution of copies of informal correspondence to all participants is desirable to keep them fully apprised of these communications. Each organizational participant will designate an individual to coordinate informal communications and assure their proper distribution within that organization.

Formal communication of project business flows through channels. Actions on and transmittal of formal communications are performed promptly. On most issues, informal communications will have occurred prior to formal communication to minimize surprise and delay and maximize success.

Management's systems for performing, and assessing adequacy of work on the FMI, including activities that relate to planning, scheduling and cost control are described in detail in the following three documents: (1) FMI Project Management Plan; (2) FMI Configuration Management Plan and (3) FMI Project Control System.

## 4.2 CRITERION 2 - PERSONNEL TRAINING AND QUALIFICATION

4.2.1 In-house training is provided to insure that an appropriate level of skills, knowledge, expertise, and experience are available to accomplish the stated mission and subordinate objectives. Training may come from several sources such as mentoring provided by physicists, engineers, supervisors, lead personnel, consulting firms, manufactures operating manuals, and other sources. Job-related training records of all assigned personnel, for work related to the FMI project, are maintained by the appropriate department. As already stated in Section 4.1.3, functional responsibilities and task descriptions at the group level are contained in the respective organization SQIP's. Associated training requirements can also be found in the appropriate SQIP.

Those appointed to management positions within the FMI Project, including Level 3 Managers, are chosen for their technical and communications skills. The AD does not specify any further training or education for these personnel beyond what they initially bring to their positions. However, the FMI Project Manager will normally request or require that personnel in management positions attend the Supervisory Development Course taught by the Laboratory Services Section. The FMI Project Manager may also suggest or require further technical or management training.

4.2.2 Environment, Safety and Health (ES&H) training is provided to all participants in FMI Project work, commensurate with the hazards associated with the work performed. The AD ES&H group maintains a data file which records the detail and extent of the training received by each person and is the basis for regular periodic assessment of on-going and repeat training requirements. For the details of the ES&H training program for workers outside of the AD see the corresponding division or section SQIP. ES&H training for civil contractor employees are described in the document "FMI ES&H Procedures for Construction," which will be incorporated as an ADSP. Specific training requirements are determined by line managers.

### 4.3 CRITERION 3 - QUALITY IMPROVEMENT

#### 4.3.1 Quality Implementation

This SQIP is the guide for the development and implementation of work procedures which support the achievement of the stated FMI mission and performance objectives. The SQIP further requires that appropriate procedures are in place and describes to what extent and how the quality requirements will be implemented. It is the intent of the FMI Project that all activities for which it is responsible be performed at a level of quality appropriate to achieving the scientific, technical, operational, and administrative objectives in a cost effective manner, and with a responsible curtailment of overzealous practices.

#### 4.3.2 Quality Responsibilities

In the FMI Project all personnel are responsible for quality and are encouraged to report conditions adverse to quality such as deviations, deficiencies, failures, defective items or processes and nonconformances promptly to the appropriate level of management for corrective action. A strong emphasis is placed on line supervision leadership, accountability, and the implementation of quality to the line level. Employees closest to the daily operation or activity are in the best position to understand and report nonconforming conditions and are encouraged to participate in quality improvements to meet the needs of the project and achieve the objectives of its mission. Management has a responsibility to evaluate such reports and proposals for improvement, consistent with optimizing achievement of functional objectives, within cost, performance and ES&H constraints.

#### 4.3.3 Performance Cause Analysis

Supplier Performance: Performance quality problems are identified and reported by a quality control report, for items such as incoming parts, assemblies and supplied purchased hardware. These reports are reviewed by the responsible authority for the area or activity that they will be used in and a disposition will be made such as scrap, return to vendor for replacement, rework at vendor, rework in house, or use as is. These reports are reviewed for supplier performance problems or trends and are used as a basis for cause analysis. Management has a responsibility to ensure that vendor performance objectives are not overstated in project specifications, and that expectations are realistic and necessary. Once established as necessary,

methodology to ensure vendor performance is a critical part of vendor performance specifications.

Work Process Performance: During assembly or fabrication work, procedures and quality control travelers are used which provide inspection criteria, check points such as pass or fail, tolerance limits, assembly procedures, engineering specifications, data gathering and discrepancy reports. This information is reviewed by the responsible authorities for the activity or area to identify quality problems and maintain operational controls, develop trends, and are used as a basis for cause analysis.

#### 4.3.4 Design Reviews

Quality improvement is also achieved by an extensive and systematic program of design reviews, at the Pre-Conceptual, Title I and Title II design stages. Details of the review processes are described under Criterion 6 in Chapter 4.6 of this document in "Design."

#### 4.3.5 QA Meetings and Reports

On the fourth Tuesday of each month at the regular weekly project meeting the FMI project manager has scheduled five minute reports from each of the Level 3 Managers. Following these reports the meeting will be devoted to QA status, problems and corrective actions. Agendas and notes from these meetings are kept in the Document Control Center.

Each FMI monthly report to DOE, beginning with the March 1993 report, will carry a section devoted to QA. This will include significant QA actions during the report period.

### 4.4 CRITERION 4 - DOCUMENTS AND RECORDS

4.4.1 In compliance with DOE Order 4700.1 (June 2, 1992 Revision) the requirements for documenting the organization, functions, policies, decisions, procedures and essential transactions of the FMI Project are specified in the FMI Project Management Plan (December 1992) and documents referenced therein.

4.4.2 The Procedure ADDP-MI-0001 "FMI Document Control Center Procedures" defines when documents should fall into the Control Document category; the procedure describes the steps required for Control Documents which includes restrictions on preparation, review, approval, issuance and revisions. The current list of FMI Controlled Documents developed to date include the following:

- The FMI Title I Report
- The FMI Procedure Handbook
- Engineering Change Requests
- The Preliminary Safety Analysis Report
- The Project Management Plan

4.4.3 Following DOE Orders 1324.2A (Records Disposition) and 1324.5 (Records Management Program), the FMI records management activities are conducted in accordance with the "Fermilab Records Management Handbook." Detailed procedures are to be found in the Controlled Document FMI Procedures Handbook. (See ADDP-MI 0001, 0002, etc.)

#### 4.5 CRITERION 5 - WORK PROCESSES

4.5.1 The FMI Project Manager's Responsibility as described in the PMP include administering, planning, organizing, and controlling the FMI Project to meet the Project technical, cost and schedule objectives. In particular the FMI Project Manager strives for effective human resource management with the goals of hiring and maintaining an efficient and effective work force.

4.5.2 The individual FMI worker is the first line in ensuring quality. FMI L3M are responsible for ensuring that people who are assigned to tasks have the appropriate academic qualification, professional certification, or skills and experience to carryout the work successfully.

4.5.3 FMI L3M are responsible for planning, authorizing, and specifying (to an appropriate level of detail) the conditions under which work is to be performed. This includes the calibration of measuring and test equipment. FMI L3M specify which work is sufficiently complex or involves sufficient hazard to be performed to written procedures. When written procedures are deemed appropriate by the FMI L3M, they will be prepared, revised, approved, and distributed as Department procedures. The FMI Project Manager, following longstanding practice in the Accelerator Division, encourages all FMI Project staff to identify and report problems to him, either publicly at the weekly meeting of FMI Project L3Ms, or privately and confidentially, as appropriate. Individual employees are "thanked", rather than "blamed", for pointing out problems to management -- in an attempt to foster a "no-fault" attitude towards employees that is recognized by the employees.

The SQIP's of the individual departments of the AD and of the other divisions and sections which are participants in the FMI Project contain additional information about the human resources management procedures used by the FMI L3M.

4.5.4 The FMI Project Manager and/or the FMI L3M define the performance objectives for which personnel will be held accountable. In addition criteria which define acceptable work performance and achievement of performance objectives with the goal of acknowledging when work has been performed acceptably and identifying areas for improvement are also defined by the FMI Project Manager and/or the FMI L3M.

As in the case of Section 4.5.3 above the SQIP's referred to contain additional details concerning the performance objectives and criteria for acceptable work performance.

4.5.5 The Fermilab contract with DOE defines a variety of management systems to be applied to material resources through the applicable DOE Orders and Code of Federal Regulations (CFR).

The FMI L3M have the responsibility to insure that equipment items shall be identified and controlled to insure their proper use, and maintained to prevent their damage, loss or deterioration.

#### 4.6 CRITERION 6 - DESIGN

4.6.1 The Fermilab Director requires that sound engineering/scientific principles and appropriate technical standards are incorporated into FMI designs to ensure that they will perform as intended. This policy is implemented by the FMI Project Manager. The FMI Title I Design Report (the FMI design handbook) has been independently reviewed in order to assure compliance with the policy.

ES&H related design input and design review requirements to ensure compliance with facility ES&H requirements are specified in the FMI PMP. These include NEPA compliance, achieved by the preparation of the FMI Environmental Assessment (EA) which lead to a Finding of No Significant Impact (FONSI) by EH-1. In addition a FMI Preliminary Safety Analysis Report (PSAR) has been completed and approved, and a Technical Safety Review (TSR) has taken place.

All work processes are assessed for their possible ES&H impact -- details of the procedures employed for these ES&H impact assessments are contained in the "FMI ES&H Procedures for Construction" documentation.

Due to the significance of these ES&H provisions the AD Head has appointed the Main Injector Safety Review Committee (MISRC), which is charged with the responsibility of providing him with the independent assurance that the FMI line organization has developed the FMI facility in accordance with both Fermilab and DOE ES&H standards and practices.

Appropriate design controls are incorporated in the FMI Configuration Management Plan (CMP) and the FMI Control System. Changes and modifications including their validation are controlled by FMI Engineering Change Request as defined in Procedure ADDP-MI-0002. Design records are incorporated into the FMI records management system (see Procedure ADDP-MI-0001).

The design input for FMI Project components and systems, as specified in the FMI Design Handbook, and as modified according to Engineering Change Requests, are incorporated into specifications and drawings under the direction of the cognizant FMI L3M. This includes items such as ES&H requirements, design bases, and reliability requirements. For major component systems, such as FMI dipole magnets and FMI dipole power supplies, the Advanced Procurement Plan process, described in Appendix I of the FMI PMP, is employed.

The design and development of computer software for the FMI will be based on Fermilab's implementation plan for DOE Order 1330.1C (Software Management).

#### 4.7 CRITERION 7 - PROCUREMENT

4.7.1 The Fermilab contract with DOE specifies a variety of management controls to be applied to procurements and sub-contracts through the applicable DOE Orders, Department of Energy Acquisition Regulations (DEAR) and Federal Acquisition Regulations (FAR). Details of Fermilab's implementation of procurement and sub-contract management controls are to be found in Fermilab Quality Assurance Program (April 1, 1992), page 6.

4.7.2 Implementation of procurement management requirements by the FMI Project is described in the FMI PMP, in particular see Annex I Advance Acquisition or Assistance Plan for the FMI. In addition the document "FMI ES&H Procedures for Construction" requires the inclusion of applicable ES&H specifications in sub-contracts.

#### 4.8 CRITERION 8 - INSPECTION AND ACCEPTANCE TESTING

4.8.1 FMI L3M define the types of work that require formal inspections and acceptance testing. When an inspection or acceptance test is performed, the characteristics and processes to be inspected or tested, the inspection techniques to be used, the hold points, and the acceptance criteria are defined as appropriate. Properly calibrated and maintained measuring and test equipment are used for acceptance testing. Further details concerning inspection and acceptance

testing can be found in the SQIP's for the AD department and other divisions and sections which are participating in the FMI Project.

4.8.2 The accelerator readiness reviews for the FMI Project will conform to the requirements of DOE Order 5480.25 (Accelerator Safety Order). The subsequent operation and maintenance of the FMI will conform to the Fermilab implementation of DOE Order 5480.19 (Conduct of Operations) and DOE Order 4330.4A (Maintenance Management Program).

#### 4.9 CRITERION 9 - MANAGEMENT ASSESSMENT

4.9.1 The FMI PMP (in particular sections IV and IX) describes how FMI Project management periodically evaluates whether or not the FMI management infrastructure and resources are properly focused on achieving the FMI mission objectives. This includes a weekly project status meeting, chaired by the Deputy Project Manager, which is attended by the FMI Project Manager, all AD/MID staff, and all Level 3 Managers.

4.9.2 The ES&H performance of the FMI Project is periodically evaluated in accordance with the AD ES&H Self-Assessment Plan.

#### 4.10 CRITERION 10 - INDEPENDENT ASSESSMENT

4.10.1 The Fermilab Director has assigned responsibility for performing independent assessment to the Quality Assurance, Conduct of Operations, and Self Assessment Offices in the directorate.

4.10.2 Independent assessments of the performance of the FMI Project by DOE consists of the following as found in the FMI PMP, page 56:

a. Weekly Meeting

A weekly meeting is held between the BAO and the FMI Project Manager to review the current status of Project work, to discuss outstanding issues, and to update previously identified action items.

b. Monthly Meeting

A monthly meeting is held between the CH, BAO and the FMI Project Manager which summarizes the monthly Project status and updates all outstanding and action items.

c. Semi-Annual Review

Approximately every six months, a comprehensive review of the Project's cost, schedule, and technical status will be held by ER. Presentations by key FMI Project personnel will address issues on an agenda agreed to in advance by CH, BAO, and the FMI Project Manager.

### 5.0 CONTROLLED DISTRIBUTION OF THIS DOCUMENT

Standard ADAP distribution.

#### 5.1 EXTRA DIVISION DISTRIBUTION

DOE FMI Project Manager  
E. G. Pewitt, Technical Services/Main Injector Magnet Manager  
Directorate Quality Assurance Office

